

CLAIMS:

1. A process for producing iron metal and slag by smelting iron-containing source material, having iron present as oxide, in a partially metallised state or a combination thereof, in a reactor containing a molten bath comprising or having a slag phase, wherein the process comprises the steps of:
- (a) injecting fuel/reductant and oxygen-containing gas into the slag, by at least one top-submerged lance, to generate heating and reducing conditions in at least one reducing region in the bath;
 - (b) feeding the source material to the reactor, together with additional reductant and with flux, at or adjacent to the at least one reducing region, whereby the source material is subjected to smelting reduction which generates combustion gases comprising CO and H₂;
 - (c) controlling the rates of injection of the oxygen-containing gas and fuel/reductant by said at least one lance to achieve required, sufficient reducing conditions; and
 - (d) post-combusting, in the reactor above the bath, the combustion gases generated by the smelting;
- wherein the controlling of step (c) is conducted to result in the injected oxygen-containing gas having an oxygen content of from about 40 volume% to about 100 volume%, and sufficient for a degree of combustion in excess of 60 wt% of the fuel/reductant injected by the at least one lance.
2. The process of claim 1, wherein the controlling of step (c) is conducted to provide a degree of combustion in excess of 65 wt% of the fuel/reductant injected by the at least one lance.
3. The process of claim 1, wherein the controlling of step (c) is conducted to provide a degree of combustion of between 65 wt% and 90 wt% of the fuel/reductant injected by the at least one lance.
4. The process of claim 1, wherein the controlling of step (c) is conducted to provide a degree of combustion of between 65 wt% and 85 wt% of the fuel/reductant injected by the at least one lance.

5. The process of claim 1, wherein the fuel/reductant and the additional reductant comprising coal are lower ranking fuel and the controlling of step (c) is conducted to provide a degree of combustion of between 60 wt% to 75 wt% of the fuel/reductant injected by the at least one lance.
6. The process of claim 1, wherein the fuel/reductant and the additional reductant comprising coal are higher ranking fuel and the controlling of step (c) is conducted to provide a degree of combustion of at least 70 wt% of the fuel/reductant injected by the at least one lance.
7. The process of any one of claims 1 to 6, wherein the post-combustion of step (d) is conducted to achieve a degree of combustion in excess of 0.2, as determined by the ratio of $(\text{CO}_2 + \text{H}_2\text{O})$ to $-(\text{CO}_2 + \text{H}_2 + \text{O}_2 + \text{H}_2\text{O})$ for resultant reactor off-gases.
8. The process of claim 7, wherein the oxidation degree is controlled to about 0.95 to 1.0.
9. The process of any one of claims 1 to 8, wherein the fuel/reductant comprises at least one carbonaceous reductant selected from particulate coal, fuel oil, natural gas and LPG.
10. The process of any one of claims 1 to 8, wherein the fuel/reductant comprises particulate coal injected by means of a carrier gas.
11. The process of claim 10, wherein the carrier gas contains at least part of the oxygen required for combustion of fuel of the fuel/reductant.
12. The process of claim 10, wherein the carrier gas is selected from nitrogen, oxygen, air and oxygen enriched air.
13. The process of any one of claims 1 to 12, wherein the additional reductant is coal.

14. The process of any one of claims 1 to 12, wherein the additional reductant is coal supplied at a rate of from about 20% to 60% by weight of the source material.

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15. The process of any one of claims 1 to 14, wherein the flux comprises at least one of limestone, dolomite, calcined lime, calcined dolomite and silica.

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16. The process of any one of claims 1 to 15, wherein the smelting is conducted at a reactor temperature of from about 1350°C to about 1500°C.

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17. The process of any one of claims 1 to 16, wherein the post-combustion is conducted by blowing into a space of the reactor, above the molten bath, an oxygen-containing gas selected from air and oxygen-enriched air.

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18. The process of any one of claims 1 to 17, wherein the post-combustion is conducted in a post-combustion zone closely adjacent to the bath surface whereby droplets of slag splashed from the bath by turbulence generated by the injecting into the slag pass through and take up heat energy in the post-combustion zone.

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19. The process of claim 18, wherein the post-combustion zone is adjacent to the at least one reducing region.

20. The process of any one of claims 1 to 19, wherein the iron-containing source material comprises lumps or agglomerated fine material.

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21. The process of any one of claims 1 to 20, wherein the iron-containing source material is at least one of iron ore lump, iron ore particulate material, pellets, pellet fines, iron sands, iron residues, scale, steel plant flue dust, ferrous scrap, partially metallised materials and high iron slag.